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TAXONOMIC OBSERVATIONS ON EASTERN PACIFIC *ANTITHAMNION* SPECIES (RHODOPHYTA: CERAMIACEAE) DESCRIBED BY E. Y. DAWSON

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Abstract.—Three of the six species of the red algal genus *Antithamnion* described by E. Y. Dawson are studied critically. Re-examination of the type specimens and study of new material of *A. hubbsii, A. pseudocorticatum,* and *A. mcnabbii* reveal that the latter two are more correctly transferred to *Balliella* and *Antithamnionella* respectively. Gland cells previously unrecognized for *B. pseudocorticata* are described, and tetrasporangia reported for the first time for *Antithamnionella mcnabbii* and *Antithamnion hubbsii.* Distribution and new records are noted for each taxon.

E. Yale Dawson (see Abbott, 1966) described a number of new taxa from the eastern North Pacific, including 6 species of *Antithamnion* Nägeli (1847) (Ceramiaceae, Ceramiales) from the Gulf of California and the Pacific coasts of California, Mexico, and Central America: *A. breviramosus* Dawson (1949), *A. dumontii* Dawson (1960), *A. hubbsii* Dawson (1962), *A. mcnabbii* Dawson (1950), *A. pseudocorticatum* Dawson (1962), and *A. scrippsiana* Dawson (1949). Later, Dawson (1953) recognized *A. scrippsiana* to be a form of *A. glanduliferum* Kylin (1925), which was later transferred by Wollaston (1971) to *Antithamnionella* Lyle (1922). She also considered *Antithamnion breviramosus* Dawson in this genus, as *Antithamnionella breviramosa* (Dawson) Wollaston (in Womersley and Bailey, 1970). Abbott (1979) transferred *A. dumontii* to *Wrangelia* C. Agardh (1828). The remaining species of Dawson, *Antithamnion hubbsii, A. mcnabbii,* and *A. pseudocorticatum,* were known only from the type collections (all sterile and their taxonomic status was incompletely known). New observations on the type specimen and on additional material identified as these species add new information on these species and, in the case of *Antithamnion pseudocorticatum* and *A. mcnabbii,* justify their transfer to other genera.

Balliella pseudocorticata (Dawson) comb. nov.
Figs. 1, 2

Basionym.—*Antithamnion pseudocorticatum* Dawson, Allan Hancock Pacific Expedition 26:20, Pl. 7, Figs. 1, 5 (1962).

Description.—Erect thallus branches to 5 mm high arising from prostrate

axes attached to substrate by long, multicellular rhizoids; branches of erect axes in opposite pairs, slightly incurved, distichous, bearing opposite pairs of 1–3 celled often once-branched, incurved whorl branchlets and with smaller, subrectangular basal cell; lateral branches with opposite whorl branchlets and with same branching as erect axes; whorl branches and branchlets incurved but not surrounding apical cell and bearing whorl branchlet initials in irregular sequence; basal cells of branches and whorl branchlets each bearing two adaxial and one to two abaxial branchlets, these remaining meristematic and becoming compound, enveloping basal portions of major branches and forming loose cortication. Gland cells spherical, (8–) 11 (–13) μm diameter, born abaxially on basal cell of whorl branchlets (Fig. 1). Gland cells usually occurring singly, but two gland cells may be present on a single whorl branchlet basal cell in older portions of the thallus. Corticating branchlets also with gland cells. Reproductive material not found.

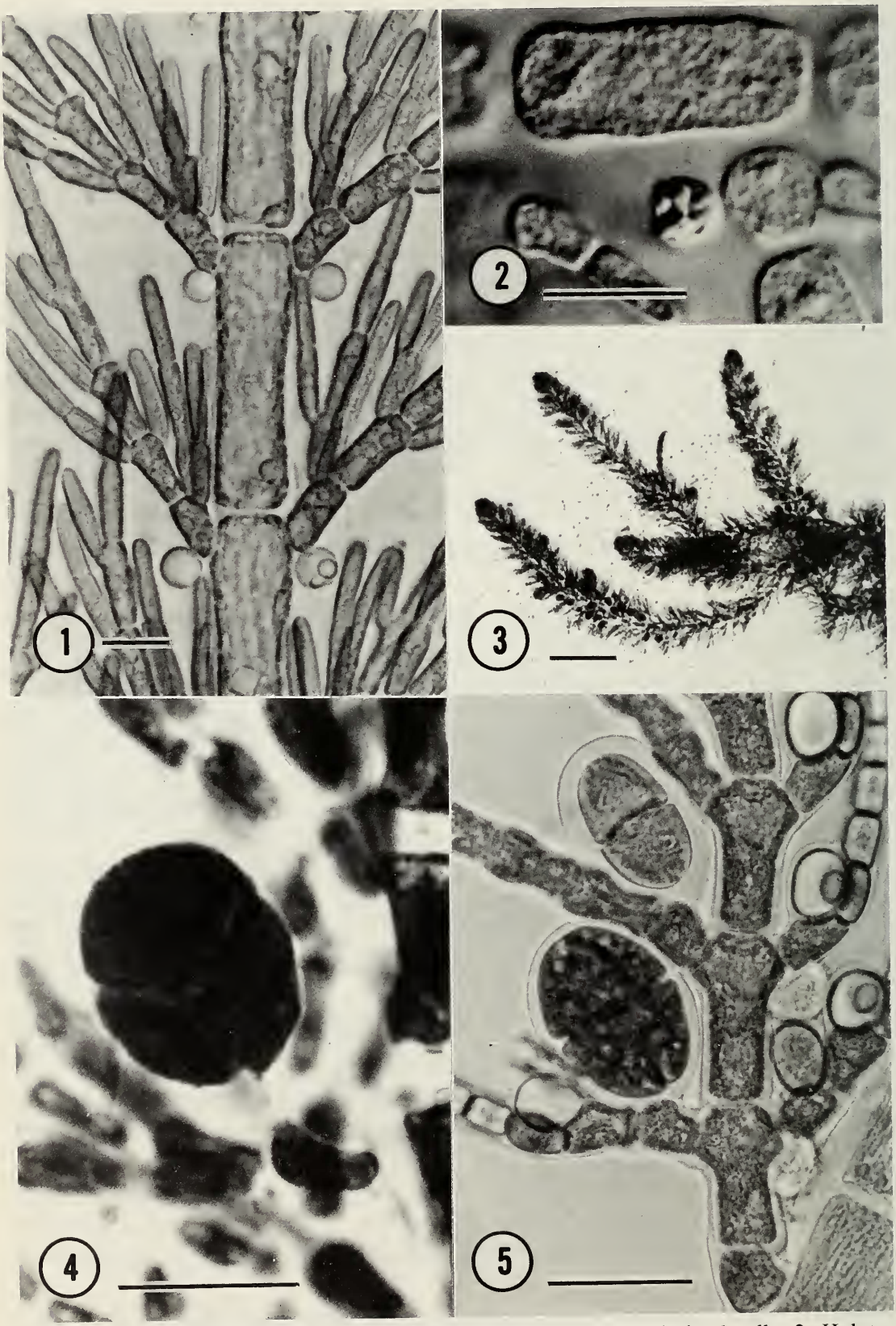
Holotype.—Dawson 6934b (AHFH 71122), 15.iii.49, San Lorenzo Channel, dredged between Isla Espiritu Santo and Baja coasts, near La Paz, Baja California del Sur, Mexico.

Additional records.—Galápagos Islands, R/V *Searcher* station 327, near Punta Espinosa, Isla Fernandina (*P. C. Silva,* AHFH 85054).

Remarks.—Dawson (1962, p. 20–21) accurately describes the plant except for the statement "gland cells absent," which is in error. It is unclear why Dawson failed to observe the gland cells in the type material. The distinctive, refractive nature of certain types of living glandular cells is lost by fixation in formalin (Young, 1977), but the cells on the formalin-preserved, Karo-mounted type specimen are clearly present (Fig. 2).

The morphology of *Antithamnion pseudocorticatum* differs from the characteristic vegetative features which define the genus *Antithamnion* (see Wollaston, 1968): axes completely lacking rhizoidal cortication; pinnae distichous and either opposite, alternate, or secund and with a small basal cell which does not bear pinnules; gland cells born on special short branches. The Gulf of California plant agrees with the features of the genus *Balliella* Itono and Tanaka (1973) in apical organization, branching pattern, development of nodal cortication of the axes, and unique gland cell shape and position. *Balliella* bears cruciately divided, adaxial tetrasporangia, and many procarps on the basal cell of subapical lateral branches. Unfortunately, the absence of reproductive material on *A. pseudocorticatum* precludes comparison of reproductive structures, but the vegetative features alone are strong evidence warranting transfer of *A. pseudocorticatum* to *Balliella*.

Prior to these observations, *Balliella* contained two species, *B. crouanioides* (Itono) Itono and Tanaka and *B. subcorticata* (Itono) Itono and Tanaka. *Balliella pseudocorticata* is easily distinguished from *B. crou-*



Figs. 1, 2. *B. pseudocorticata:* 1, Living specimen with adaxial gland cells; 2, Holotype with gland cell. Figs. 3, 4. *A. mcnabbii:* 3, Habit; 4, Tetrasporangium. Fig. 5. *A. hubbsii,* pinnules with tetrasporangia. Figs. 1, 2, 4, 5, bar is 50 μm; Fig. 3, bar is 200 μm.

anioides by its irregular branching pattern and the compact nature of the nodal cortication in the latter species. *Balliella pseudocorticata* is smaller and stouter than *B. subcorticata,* but otherwise seems similar. The recently described *Bakothamnion curassavicum* van den Hoek (1978) from the eastern Caribbean may be placed more properly in *Balliella* (van den Hoek, pers. comm.). In view of environmental effects on thallus form in the Ceramiaceae (Murray and Dixon, 1973), re-examination of variation in *B. subcorticata* and comparisons with the Caribbean and western Pacific plants is desirable.

Antithamnionella mcnabbii (Dawson) comb. nov.
Figs. 3, 4

Basionym.—*Antithamnion mcnabbii* Dawson, Los Angeles County Museum Contributions in Science 27:28, Fig. 7C. 1959.

Description.—Erect thallus minute, to 8 mm tall (Fig. 3), attached to substrate by unbranched, multicellular rhizoids originating from basal cell of lateral branchlets; axes ecorticate; whorl branchlets short, slightly incurved, usually in threes, forked 3–5 times with a digitate appearance, from subrectangular basal cells; axial cell bearing lateral branches also with a whorl of three branchlets; lateral branches 304 segments apart with whorl in branchlets as in main axis; gland cells absent in type; tetrasporangia (Fig. 4) spherical to subspherical, tetrahedrally divided, sessile, frequently with additional branchlets on the basal cell of a lateral branch; male and female structures unknown.

Holotype.—*Dawson 18855,* 20.iv.58, from El Solitario Rock, Bahía Agua Verde, Baja California del Sur, Mexico (LAM now AHFH 81902).

Additional records.—I have examined material of this species from the Gulf of California, now deposited in AHFH and US. Sterile material from Isla Fernandina, Galápagos Islands (*P. C. Silva,* AHFH 85053) and tetrasporic material from Caleta Santa Maria, Baja California del Sur (*J. Norris* 3406, US) was examined.

Remarks.—Tetrasporic material from the Gulf of California (*J. Norris* 3406) clearly exhibits stages in the simultaneous, oblique cleavage process characteristic of tetrahedral division (Wollaston, 1968). The previous report (Itono, 1969) of cruciate tetrasporangia in *Antithamnion mcnabbii* from Japan is considered by Itono (1977) to be a doubtful record for that species. The Japanese specimen is similar to Mexican specimens, and Itono's (1969) Fig. 5A, if judged alone, could represent tetrahedral division.

This species exhibits features in common with *Antithamnionella* Lyle (1922) and excluding it from *Antithamnion* Nägeli (Wollaston, 1968): the shape and tetrahedral cleavage of tetrasporangia, the pinnae in whorls of three, the shape of basal cell of pinnae, the absence of gland cells on special gland cell branches. Likewise, the branch morphology and the sessile tet-

rasporangia of *A. mcnabbii* exclude this species from *Scagelia* Wollaston (1971) and *Hollenbergia* Wollaston (1971). The digitate morphology of the whorl branchlets and absence of gland cells distinguish *Antithamnionella mcnabbii* from the North Pacific species of this genus, *A. glandulifera* (Kylin) Wollaston and *A. pacifica* (Harvey) Wollaston and from the Japanese species, *A. miharai* (Tokida) Itono (1977). Vegetatively, *A. mcnabbii* seems most closely related to *A. breviramosa* (Dawson) Wollaston, also from Pacific Mexico and the Gulf of California (Dawson, 1962), which has considerable variation in numbers of gland cells present.

Antithamnion hubbsii Dawson
Fig. 5

Antithamnion hubbsii Dawson, Allan Hancock Pacific Expeditions 26:16, Pl. 5, Fig. 2; Pl. 6, Fig. 3. 1962.

Description.—The vegetative aspects of this species were described completely by Dawson (1962) and Wollaston (in Abbott and Hollenberg, 1976). Recent California collections identified as this species allow the following description of previously unknown tetrasporangia. Mature tetrasporangia (Fig. 5) are ovoid, 35 × 60 μm, sessile, usually in place of gland cells on pinnules of first or second cell (not basal cell) of pinnae on erect axes.

Holotype.—Dawson 8302 (AHFH 71130), 19.xii.49, from 70 m depth, Melpomene Cove, Isla Guadalupe, Mexico (R/V *Velero* station 1919-49).

Additional records.—Various collections from subtidal areas at Santa Catalina Island, California (*Hageman 24,* AHFH; *Young 998*), and from the Dana Point Marina, Orange County, California (AHFH 85052, 85053) were examined. Previously known only from type locality and Santa Catalina Island (Wollaston in Abbott and Hollenberg, 1976).

Remarks.—The tetrasporangial and vegetative features of this distinctive species are consistent with its placement in *Antithamnion. Antithamnion hubbsii* has similarly placed, but smaller, tetrasporangia than the similar *A. callocladus* Itono (1971), which is overall more robust and contains 1–2 more orders of branching than the former species.

California specimens differ somewhat from the holotype in that the basal cells of the pinnae on prostrate axes bear two attachment rhizoids whereas single rhizoids are formed from pinnae on erect axes.

This species is relatively abundant in appropriate habitats in southern California, but gametangial material remains unknown. To date, my attempts to obtain gametophytes by cultivation of tetraspores have been unsuccessful.

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